Slow changes in heat and freshwater content in the transition region of the North Atlantic subpolar and subtropical gyres

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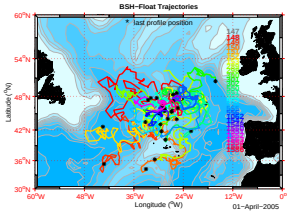
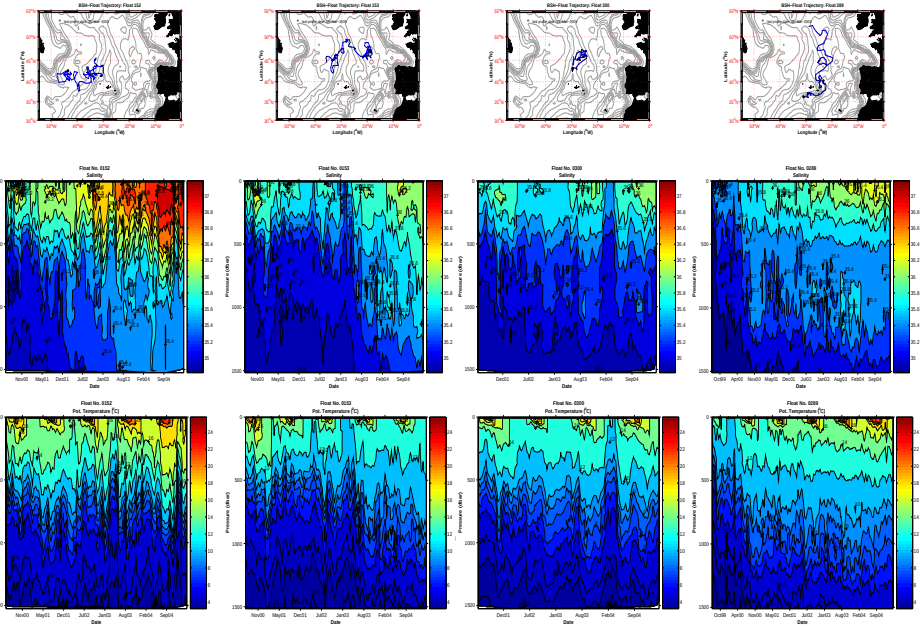
For the transition region between the two main gyres in the North Atlantic we describe changes of heat and freshwater content with a time resolution of half a month between 1998 and 2005 from profiling float data. These will be complemented with high-resolution repeat hydrography since 1993 along 48°N (WOCE-A2). Changes differ for the areas west and east of the Mid-Atlantic Ridge (MAR). The barotropic circulation crossing the MAR plays a major role in determining these changes. Currently 29 floats are active and transmitting data. Latest float trajectories are displayed on the right. Another 10 floats will be deployed this year.

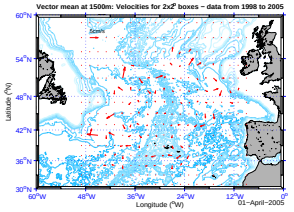


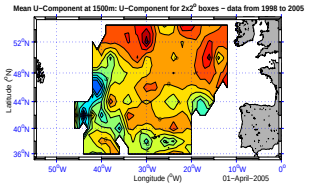


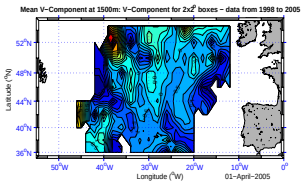
Regional Float Examples:
Trajectories, salinity and potential temperature isopleths of four different Apex floats (Float 152, 153, 300 and 289) are constructed from uncorrected data. Only for the salinity sensor of float 152 preliminary checks indicate a drift.
Float 152 deployed in May 2000 west of the MAR runs in a westward direction. Float 153 started also in May 2000 in the western basin of the North Atlantic running eastward, crossing the MAR. The track of float 300 is quasi-stationary above the MAR, starting in May 2001. The longest living float 289 started in June 1999 on the eastern side of the MAR and moves along the isobaths from north to south.

The seasonal cycle reaches to a depth between 500 and 800 m. Winter deep convection is absent in January/ February in the southeast sector of the area, south of 45°N and east of 30°W. Deep convection down to 1500 m in winter either appears in the subpolar gyre (float 289) or when the floats are above the MAR. Float 300 has deep convection in February 2004 and float 153 in January 2003.
The salinity isopleths of float 289 show the propagation from the subpolar gyre with relatively low salinities to the subtropical gyre with higher salinites.

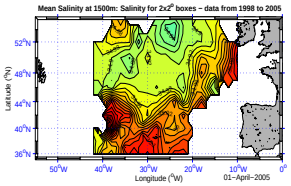
Mean Flow Field at 1500 m Depth:
Velocities of all floats operating between 1998 and 2005 at depths of 1500 m were averaged on a 2x2° grid. The flow field shows a strong topographic steering along the eastern side of the MAR. Floats cross the MAR from the Western to the Eastern Basin preferably at the fracture zones between 42°N and 48°N. Highest velocities appear on the western side of the North Atlantic, with floats caught in the Deep Western Boundary Current and its recirculation. Low velocities appear above the central MAR. A pronounced westerly flow is observed south of the Azores.

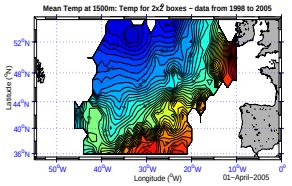






Mean U- and V- Velocity Components:
The velocity field is decomposed into its u- and v-components shown in the figures above. Highest u-values appear at the boundaries of the basins and flow is weaker over the Mid Atlantic Ridge. North of 46°N eastward flow prevails, south of 40°N we observe westward flow.
Strong northward flow is only observed at the westernmost boundary and west of the MAR. In the eastern basin the southward flow is slightly intensified along the eastern flank of the MAR. Further east towards the eastern side of the investigation area it increases up to 1.5 cm/s.





Mean Salinity and Temperature Field at 1500 m Depth:
Salinities and temperatures from float data collected between 1998 and 2005 were averaged on a 2x2° grid. The front of the subpolar and subtropical gyres is clearly lined out in the salinity field and crosses the MAR at 42°N. From 36°N to 42°N influences from Mediterranean Water are visible. Less saline waters of the subpolar gyre occupy the area to the north.
The sharp temperature front between the subpolar gyre and the subtropical gyre crosses the MAR at 40°N and is displaced southward of the salinity front by some 2° in latitude. The northward edge of the subtropical gyre is strongly influenced by the Mediterranean Water tongue.
These fields will be compared in the near future with the WOCE Global Hydrographic Climatology (WGHC) to obtain anomalies.

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